

**Tamias bulleri.** By Jarel L. Bartig, Troy L. Best, and Stephanie L. Burt

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***Tamias bulleri* J. A. Allen, 1889**

**Buller's Chipmunk**

*Tamias asiaticus bulleri* J. A. Allen, 1889:173. Type locality "Sierra de Valparaiso, Zacatecas," Mexico.

*Tamias bulleri* Trouessart, 1897:431. First use of current name combination.

**CONTEXT AND CONTENT.** Order Rodentia, Suborder Sciuromorpha, Family Sciuridae. The genus *Tamias* contains ca. 24 species (Honacki et al., 1982). *T. bulleri* is in the subgenus *Neotamias* and the *merriami* species group (Levenson et al., 1985). *T. bulleri* is monotypic (Callahan, 1980).

**DIAGNOSIS.** The skull (Fig. 1) is larger (Howell, 1929), and the baculum (Fig. 2) is thicker and markedly wider than many other species of *Tamias* (White, 1953). *T. bulleri* and *T. durangae* from geographically adjacent sites show no intergradation in genital morphology or in any other characters (Callahan, 1980). The shaft of the baculum of *T. durangae* is longer, the angle is greater, and the height of the keel is less than in *T. bulleri* (Fleaharty, 1960).

*Tamias bulleri* consistently lacks the cinnamon dorsal coloration and the underside of the tail is pale yellowish-tan. By contrast, the upperparts of *T. durangae* are suffused with cinnamon, and the underside of the tail, except in a few *T. durangae* taken outside the range of *T. bulleri*, is dark reddish-brown (Callahan, 1980). *T. durangae* from Durango is similar to *T. bulleri* from southwestern Zacatecas, but larger and paler, with the white markings on the head broader and the white postauricular patch larger. Rump, basal portion of tail, and flanks are faintly suffused with a pale tinge of buff instead of gray as in *T. bulleri*. The dark dorsal stripes are similar in extent and in color, but the intervening pale stripes are suffused with pale cinnamon instead of nearly clear white as in *T. bulleri*, and the rufous on the flanks is much paler (Allen, 1903).

Buller's chipmunk is similar to *T. canipes*, but sides are paler, head is darker, ocular stripe is broader, submalar stripe and sides of nose are darker, and the median dorsal stripe between the ears is broader and more blackish. In addition, the outer pair of dark stripes is darker (more blackish), feet average more buffy, tail is paler beneath, hind foot is larger, skull is larger, and ears average broader and less pointed (Howell, 1929).

*Tamias bulleri* resembles *T. cinereicollis* in size and general proportions, in the character and color of the dorsal stripes, and in general coloration. It differs from *T. cinereicollis* in its shorter and less pointed ears, the sides are pale buff-brown instead of strong yellowish-brown, the central area of the tail is ochraceous instead of orange rufous, and especially the stronger contrast between pale and dark facial streaks; the superciliary one is broader and whiter, and all the dark ones are broader and darker, with the eye stripe twice as broad and black instead of pale rusty brown (Allen, 1890). *T. bulleri* also has a darker head, a broader and more blackish ocular stripe, a paler underside of tail and sides of body, and paler hind feet (color nomenclature follows Ridgway, 1912—Howell, 1929).

**GENERAL CHARACTERS.** Ears are large, rather high, broad, and broadly rounded at the tip. The inner surface and the anterior, external border of the ear are dull rusty in color nearly to the tip. The posterior external border of the ear is grayish (sometimes fulvous) white, shading forward so as to broadly margin the whole top of the ear. Between these two bands at the base of the ear is a broad triangle of black, the apex of the triangle reaching as far as the distal one-third of the ear. The exterior surface of the ear is thus sharply tricolored. Top of the head is grayish brown with a slight mixture of rusty. Behind the ear is an oblong, broad, conspicuous patch of grayish white (Allen, 1889).

Sides of body, buttocks, and dorsal surface of tail are pale

olivaceous-gray, mixed with black on the tail; more fulvous on sides of the body in front of the hind quarters, and more whitish on sides of the neck. The dorsal region has five dark and four pale stripes. The three median dark bands are deep black, mixed with rufous at their edges. The two outer dark stripes (one on each side) are shorter and extend only from the shoulders to the hips. These stripes are

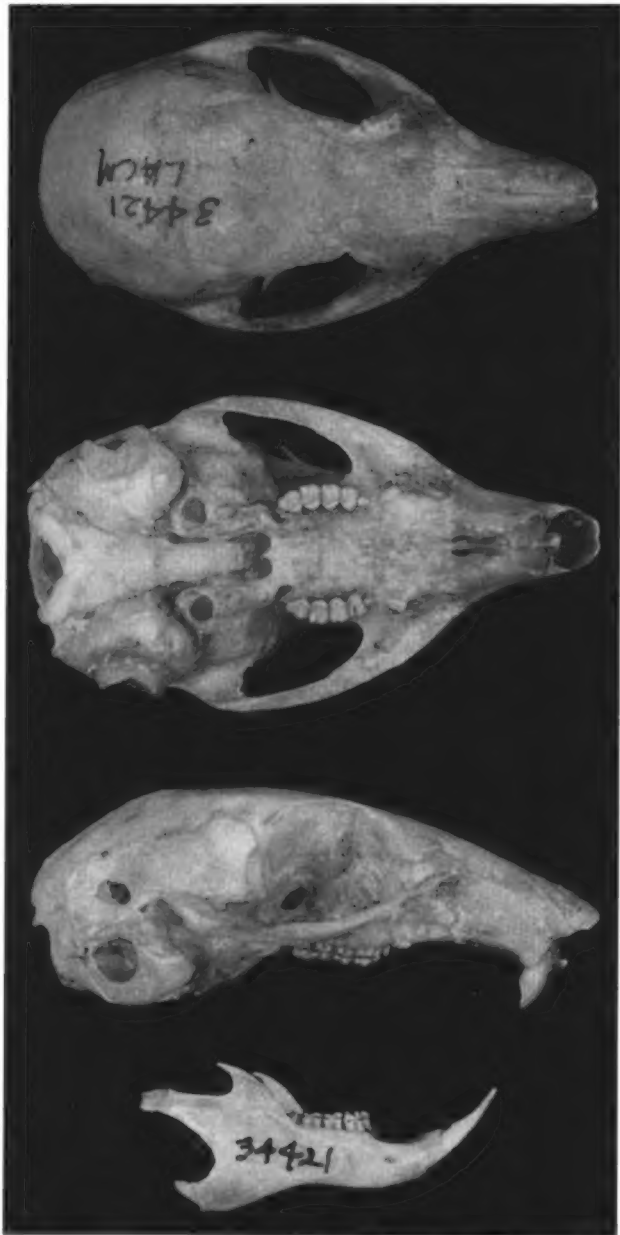


FIG. 1. Dorsal, ventral, and lateral views of cranium and lateral view of mandible of *Tamias bulleri* from 16 km SW Chalhuites, 2,160 m, Zacatecas, Mexico (female, Los Angeles County Museum of Natural History 34421). Greatest length of cranium is 38.7 mm. Photographs by T. H. Henry.

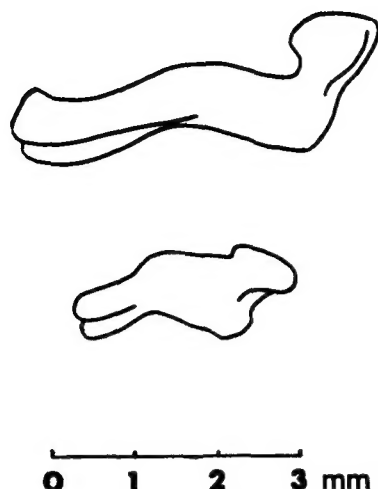


FIG. 2. Right lateral view of male (above) and female (below) ossa genitalia of *Tamias bulleri* (modified from Callahan, 1980).

dark rufous-brown, often bordered sharply with black on their upper border, and usually not trenchantly defined below, but shading gradually into the pale olivaceous-fulvous of the sides. The two middle pale stripes are gray, mixed with rusty on the edges. The two outer pale stripes are grayish white, or nearly pure white. The median black stripe begins at the anterior border of the crown and runs to the base of the tail; the black stripe on either side of this begins at the shoulder and extends behind the hips (Allen, 1889).

Sides of nose, cheeks, underparts, and upper surface of the fore and hind feet are soiled white, or olivaceous grayish-white, this color extending onto the forearm and back on the inner edge of the hind feet to the heel. The posterior upper surface and outer edge of the heel is dusty gray or blackish. The lower surface of the tail is dull yellow in the middle, narrowly bordered on either side and at the tip with black, with tips of the hairs olivaceous gray; the tail is narrow and thin. Facial markings are as follows: a broad superciliary stripe of white, running from the nose to the anterior base of the ear; above this and immediately bordering it is a narrower, but sharp, line of black, of similar extent, this line joining its fellow at the nose, where they form a conspicuous V-shaped mark. Below the superciliary stripe is a broad ocular stripe of black forming a broad oblong patch of black behind the eye, mixed with rusty at its posterior border. This postauricular spot, 6.4 by 10 mm in size, is a strikingly distinctive feature. Below the black ocular stripe is a distinct subocular stripe of white extending posteriorly from the sides of the nose and joining the large white spot behind the ear. Below this subocular white band is a narrow, but well-defined, streak of deep-rusty brown mixed with a variable amount of black (Allen, 1889).

Average and range of measurements (in mm) of male and female *T. bulleri*, respectively, are: length of head and body, 135 (119–147), 140 (127–144); length of tail vertebrae, 102 (94–112), 92 (77–108); length of hind foot, 37 (34–37), 36 (30–38); greatest length of skull, 38.0 (37.2–38.6), 38.3 (37.0–39.5); length of rostrum, 14.4 (13.9–14.8), 14.4 (14.0–14.9); length of braincase, 23.7 (22.9–24.3), 23.9 (23.0–24.6); length of maxillary toothrow, 6.0 (5.7–6.4), 6.1 (5.7–6.7); length of nasals, 11.7 (10.2–12.3), 11.6 (10.5–12.4); zygomatic breadth, 20.2 (19.4–20.8), 20.6 (20.1–21.5); depth of cranium, 15.0 (14.3–15.5), 14.8 (14.5–15.3); least interorbital breadth, 8.6 (7.9–9.5), 8.6 (8.3–9.2); breadth of cranium, 17.7 (17.3–18.4), 17.7 (17.3–18.5); breadth of rostrum, 9.3 (8.5–9.8), 9.3 (8.3–10.7); width of nasals, 3.0 (2.5–3.8), 2.8 (2.5–3.3—Callahan, 1980). Additional measurements are: length of tail to end of hairs, 125; height of ear from occiput, 37.3; breadth of ear at base, 37.3 (Allen, 1889).

Sexual dimorphism was present in 14 characters examined; males were longer-tailed, narrower-skulled, and smaller than females (Callahan, 1980). Comparison of 11 characters of males and females from Jalisco indicated sexual dimorphism was present in total length (Genoways and Jones, 1973). However, no sexual dimorphism was detected in another study (Levenson, 1990).

**DISTRIBUTION.** *Tamias bulleri* occupies the southernmost distribution of the genus *Tamias*. The range is restricted to Durango,

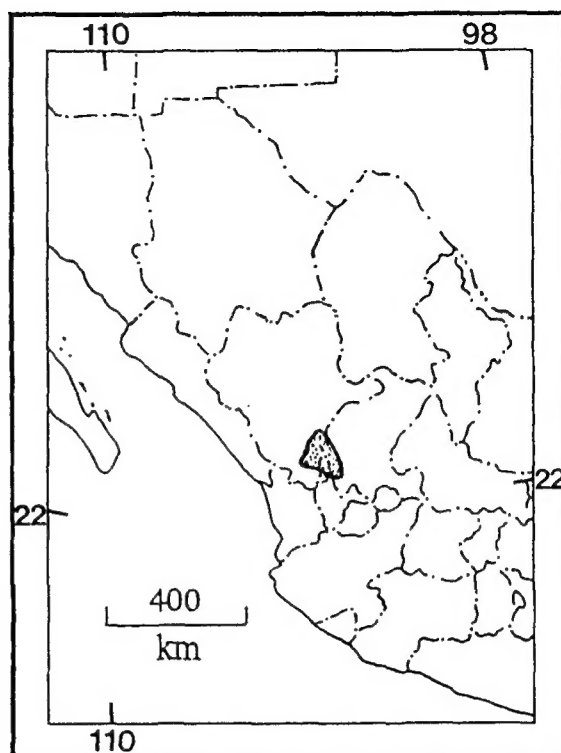


FIG. 3. Distribution of *Tamias bulleri* in Mexico (Callahan, 1980; Hall, 1981).

Jalisco, and Zacatecas (Fig. 3—Callahan, 1980; Hall, 1981). In Jalisco, the species occupies an area of ca. 4 km<sup>2</sup> (Genoways and Jones, 1973). In Zacatecas, it occurs in the southern end of the Sierra Madre in the transition zone at elevations of 2,400–2,610 m (Miller and Kellogg, 1955).

**FOSSIL RECORD.** *Tamias* evolved by the early Miocene (Black, 1972). No fossils of *T. bulleri* are known.

**FORM AND FUNCTION.** In Jalisco on 9–13 November, four *T. bulleri* showed molt from one adult pelage to another, two were molting from subadult to adult pelage, and two were in new pelage (Genoways and Jones, 1973). In summer pelage (July and August), the top of the head is fuscous or bister, sparingly mixed with grayish white. Sides of crown are bordered with fuscous black. Ocular stripe is broad, black, and edged with mikado brown. Submalar stripe is mikado brown mixed with fuscous black. Ears are chaetura drab, broadly margined posteriorly with grayish or buffy white, and edged on the anterior margin with sayal brown. Postauricular patches are prominent and grayish-white in color. Dorsal stripes are black, margined with mikado brown. Lateral stripes are mikado brown and rather indistinct. The median pair of pale stripes is grayish-white and the outer pair is white. Sides are dull cinnamon buff shaded with sayal brown, becoming pinkish buff on the shoulders. Rump and thighs are mixed-cinnamon buff and smoke gray. Feet are pinkish buff or clay color shaded with grayish white. The tail is fuscous black above, overlaid with pinkish buff. Beneath, the tail varies from cinnamon buff to sayal brown or ochraceous tawny. Underparts are creamy white. Winter pelage (November and December) is similar to summer pelage, but dorsal stripes are less contrasted in color. The median pair of pale stripes is mixed with sayal brown and the outer pair is creamy white. The outer pair of dark stripes is mixed with mikado brown (color nomenclature follows Ridgway, 1912—Howell, 1929).

The shaft of the baculum is thick and of medium length (3.30 mm). The keel is high, long, and is 50% of the length of the tip. The tip is 40–48% of the length of the shaft. The angle formed by tip and shaft is 100°. The base is markedly widened. The large size of the keel of the baculum in this species is distinctive among chipmunks of western North America (White, 1953).

**ONTOGENY AND REPRODUCTION.** In Durango, a female (either *T. bulleri* or *T. durangae*) had two embryos on 18 July and another had three embryos on 26 June. Lactating females occurred from 27 June to 20 July (Baker and Greer, 1962). On 13 May, a subadult was observed in Durango. This suggests that breeding may begin as early as January (Callahan, 1976).

In young Buller's chipmunks, the pelage is softer and fuller than in adults (Allen, 1889). Young-of-the-year that are nearly full grown differ from adults in being more heavily washed on the flanks with rusty brown, and the dorsal stripes, particularly the middle pair, are faintly suffused with rusty (Allen, 1890).

**ECOLOGY.** Buller's chipmunk occupies the Sierra Madre Occidental biotic province, located along the continental backbone of western Mexico. This area is a rolling plateau at an altitude of 2,100–2,400 m; the western side is deeply cut by canyons providing drainage to the Pacific Ocean. The climate is rather dry, although heavy rains are frequent during summer and some snow falls on upper slopes in winter and as late as May. Upper slopes of the mountains primarily are covered with forests of pine (*Pinus*) and oak (*Quercus*) with scattered pinabete (*Abies religiosa*), Douglas fir (*Pseudotsuga menziesii*), and quaking aspen (*Populus tremuloides*). At lower levels in the upper Sonoran zone, oaks, many shrubs (including manzanita, *Arctostaphylos pungens*), several species of mountain mahogany (*Arctocarpus*), and *Ceanothus* become dominant (Goldman, 1951).

Near Huejuquilla, Jalisco, *T. bulleri* was abundant near houses and along a large stream with numerous rocky arroyos. Rocky cliffs along the valley and adjacent arroyos were covered with oak. Areas beyond the valley were forested by oak, along with a few small pines and manzanita (Genoways and Jones, 1973). In western Zacatecas, it is a characteristic species in montane pine-oak forests of the Sierra Madre Occidental. It is more common where woodlands have a rocky or log-strewn substrate (Matson and Baker, 1986).

*Tamias bulleri* occupies rocky cliffs on the semiarid east-facing slope of the Sierra Madre between the Río Nazas and Río Mezquital in Durango. On the mesic west-facing slope, between these rivers, *T. bulleri* is replaced by *T. durangae*. On the east-facing slope north of the Río Nazas, *T. bulleri* is replaced by *T. dorsalis* (Callahan, 1980). *T. bulleri* occupies fertile and well-wooded habitat instead of the desert area inhabited by *T. dorsalis* (Thomas, 1882). South of the Río Mezquital, *T. bulleri* appears to be the only chipmunk present (Callahan, 1980).

It has been stated that the deeply entrenched canyon of the Río Mezquital–Río San Pedro, which cuts entirely through the Sierra Madre Occidental to drain parts of the open lands to the eastward, presents a barrier separating *T. bulleri* and *T. durangae* (Baker and Greer, 1962). As predicted, *T. durangae* occurs north of the canyon; however, *T. bulleri* occurs on both sides of this deep canyon (Callahan, 1980).

*Tamias bulleri* has close affinities with species occurring in the mountains of western Mexico (Schmidly, 1977). Mammals occurring in the same biotic province include *Sorex vagrans*, *Ursus americanus*, *Procyon lotor*, *Spilogale gracilis*, *Mephitis mephitis*, *Urocyon cinereoargenteus*, *Canis latrans*, *C. lupus*, *Felis concolor*, *Spermophilus variegatus*, *S. madrensis*, *Tamias dorsalis*, *Sciurus aberti*, *S. apache*, *Glaucomys volans*, *Thomomys umbrinus*, *Peromyscus melanotis*, *P. boylii*, *P. truei*, *P. difficilis*, *Sigmodon hispidus*, *Neotoma albigula*, *N. mexicana*, *Nelsonia neotomodon*, *Microtus mexicanus*, *Sylvilagus floridanus*, and *Odocoileus virginianus* (Goldman, 1951). Within its small range in Jalisco, *T. bulleri* occupies the same habitat as *S. variegatus*, *Sciurus nayaritensis*, *P. boylii*, *N. mexicana*, *U. cinereoargenteus*, *Bassariscus astutus*, *Nasua nasua*, and *Conepatus mesoleucus* (Genoways and Jones, 1973).

In Durango, at least six *T. bulleri* were observed foraging on small flowers in an oak tree (*Quercus*). Other individuals were observed eating juniper (*Juniperus*) seeds and one was chewing on the new growth at the tip of a pine (*Pinus*) branch (J. R. Callahan, in litt.).

Fleas and roundworms parasitize *T. bulleri* in Durango. The fleas were tentatively identified as *Monopsyllus polumus*, but the identity of the roundworms is unknown. In addition, one *T. bulleri* had a mange-like skin disease around its ears (J. R. Callahan, in litt.).

**BEHAVIOR.** *Tamias bulleri* has a vocalization apparently not given by any other species of *Tamias*. The unique sound was

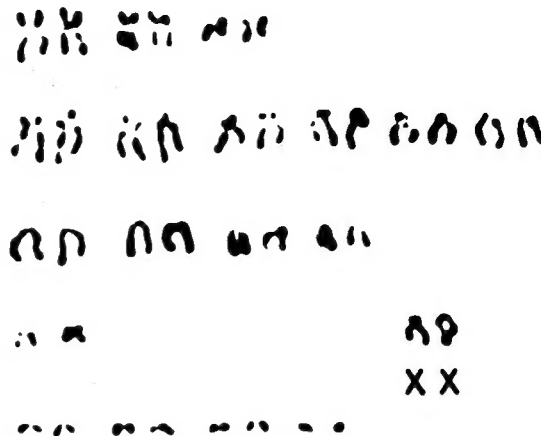


FIG. 4. Karyotype of *Tamias bulleri* (modified from Callahan, 1977).

produced by females at two localities in Durango. Other vocalizations of *T. bulleri* include "chuck," "chip," and "trill." The chip has one or more distinct terminal pulses (Callahan, 1980).

Buller's chipmunk occupies hollow trees (Allen, 1889) and ground dens. Seasonal pattern of usage has not been determined (Callahan and Estep, 1982).

**GENETICS.** *Tamias bulleri* has karyotype A of *Tamias* (Fig. 4; Callahan, 1980). The diploid karyotype contains 38 chromosomes including three pair of large metacentric, six pair of large submetacentric, four pair of large acrocentric, one pair of small metacentric, and four pair of small acrocentric chromosomes. The X chromosome is submetacentric and the Y is acrocentric (Sutton and Nadler, 1969).

**REMARKS.** Based upon phenetic analyses of morphologic data, *T. bulleri* is similar to *T. canipes*, *T. cinereicollis*, *T. dorsalis*, *T. durangae*, *T. merriami*, *T. obscurus*, *T. quadrimaculatus*, *T. sonomae*, and *T. townsendii* (Levenson et al., 1985; Nadler et al., 1985). *T. bulleri* may include two sibling species, *T. bulleri* and *T. canipes*. If this is correct, *T. bulleri* is restricted to the arid eastern slope of the Sierra Madre, while *T. canipes* occupies more mesic habitats on the western slope (Callahan, 1976, 1980). *T. bulleri* and *T. cinereicollis* may be closely related (Baker, 1956).

*Tamias* is from the Greek *tamias* meaning a storer or distributor (Jaeger, 1955). The specific epithet *bulleri* is named for Audley Buller, in recognition of his intelligent and important field work (Allen, 1889). Additional common names include Mexican chipmunk (Allen, 1890) and Sierra Madre chipmunk (Gordon, 1943).

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